

CLAIMS

1. A laser processing method of irradiating a substrate having a front face formed with a laminate part including a plurality of functional devices with laser light while locating a light-converging point within the substrate so as to form a modified region to become a start point for cutting within the substrate along a line to cut of the substrate,

5 the method comprising the steps of:

forming a first modified region along the line to cut at a position where a distance between the front face and an end part on the front face side is 5 μm to 15 μm ; and

10 forming at least one row of a second modified region along the line to cut at a position between the first modified region and a rear face of the substrate.

2. A laser processing method of irradiating a substrate having a front face formed with a laminate part including a plurality of functional devices with laser light while locating a light-converging point within the substrate so as to form a modified region to become a start point for cutting within the substrate along a line to cut of the substrate,

15 the method comprising the step of forming a first modified region along the line to cut at a position where a distance between the front face and an end part on the front face side is 5 μm to 15 μm .

20 3. A laser processing method according to claim 1 or 2, wherein the first modified region is formed at a position where the distance between the front face and the end part on the front face side is 5 μm to 10 μm .

25 4. A laser processing method of irradiating a substrate having a

front face formed with a laminate part including a plurality of functional devices with laser light while locating a light-converging point within the substrate so as to form a modified region to become a start point for cutting within the substrate along a line to cut of the substrate,

5 the method comprising the steps of:

 forming a first modified region along the line to cut at a position where a distance between the front face and an end part on a rear face side is [(the substrate thickness) x 0.1] μm to [20 + (the substrate thickness) x 0.1] μm ; and

10 forming at least one row of a second modified region along the line to cut at a position between the first modified region and a rear face of the substrate.

5. A laser processing method of irradiating a substrate having a front face formed with a laminate part including a plurality of functional devices with laser light while locating a light-converging point within the substrate so as to form a modified region to become a start point for cutting within the substrate along a line to cut of the substrate,

15 the method comprising the step of forming a first modified region along the line to cut at a position where a distance between the front face and an end part on a rear face side is [(the substrate thickness) x 0.1] μm to [20 + (the substrate thickness) x 0.1] μm .

20 6. A laser processing method according to claim 4 or 5, wherein the first modified region is formed at a position where the distance between the front face of the substrate and the end part of the first modified region on the rear face side is [5 + (the substrate thickness) x 0.1] μm to [20 + (the substrate thickness) x 0.1] μm .

7. A laser processing method according to claim 6, wherein the first modified region is formed at a position where the distance between the front face of the substrate and the end part of the first modified region on the rear face side is $[5 + (\text{the substrate thickness}) \times 0.1] \mu\text{m}$ to $[10 + (\text{the substrate thickness}) \times 0.1] \mu\text{m}$.

5 8. A laser processing method according to one of claims 1 to 7, wherein the substrate is a semiconductor substrate, and wherein the first and second modified regions include a molten processed region.

10 9. A laser processing method according to one of claims 1 to 8, wherein the first and second modified regions are successively formed one by one from the side farther from the rear face while using the rear face as a laser light entrance surface.

15 10. A laser processing method according to one of claims 1 to 9, wherein the laser light has an energy of $2 \mu\text{J}$ to $50 \mu\text{J}$ when forming the first modified region.

11. A laser processing method according to one of claims 1 to 10, wherein the laser light has an energy of $1 \mu\text{J}$ to $50 \mu\text{J}$ when forming the second modified region.

20 12. A laser processing method according to one of claims 1 to 11, wherein the light-converging point of the laser light is located at a position distanced by $50 \mu\text{m}$ to $[(\text{the substrate thickness}) \times 0.9] \mu\text{m}$ from the rear face when forming the second modified region.

25 13. A laser processing method according to one of claims 1 to 11, wherein the light-converging point of the laser light is located at a position distanced by $20 \mu\text{m}$ to $110 \mu\text{m}$ from the rear face when forming the second modified region.

14. A laser processing method according to one of claims 1 to 13, further comprising the step of cutting the substrate and laminate part along the line to cut.

5 15. A semiconductor chip comprising a substrate; and a laminate part, disposed on a front face of the substrate, including a functional device;

10 wherein a first modified region extending along a rear face of the substrate is formed at a position where a distance between the front face and an end part on the front face side is 5 μm to 15 μm in a side face of the substrate; and

wherein at least one row of a second modified region extending along the rear face is formed at a position between the first modified region and the rear face in the side face of the substrate.

15 16. A semiconductor chip comprising a substrate; and a laminate part, disposed on a front face of the substrate, including a functional device;

20 wherein a first modified region extending along a rear face of the substrate is formed at a position where a distance between the front face and an end part on the front face side is 5 μm to 15 μm in a side face of the substrate.

17. A semiconductor chip comprising a substrate; and a laminate part, disposed on a front face of the substrate, including a functional device;

25 wherein a first modified region extending along a rear face of the substrate is formed at a position where a distance between the front face and an end part on the rear face side is [(the substrate thickness) x

0.1] μm to [20 + (the substrate thickness) \times 0.1] μm in a side face of the substrate; and

wherein at least one row of a second modified region extending along the rear face is formed at a position between the first modified region and the rear face in the side face of the substrate.

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18. A semiconductor chip comprising a substrate; and a laminate part, disposed on a front face of the substrate, including a functional device;

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wherein a first modified region extending along a rear face of the substrate is formed at a position where a distance between the front face and an end part on the rear face side is [(the substrate thickness) \times 0.1] μm to [20 + (the substrate thickness) \times 0.1] μm in a side face of the substrate.

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19. A semiconductor chip according to claim 17 or 18, wherein the first modified region is formed at a position where the distance between the front face of the substrate and the end part of the first modified region on the rear face side is [5 + (the substrate thickness) \times 0.1] μm to [20 + (the substrate thickness) \times 0.1] μm .

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20. A semiconductor chip according to one of claims 15 to 19, wherein the substrate is a semiconductor substrate, and wherein the first and second modified regions include a molten processed region.

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21. A semiconductor chip according to one of claims 15 to 20, wherein the distance between the end part of the first modified region on the rear face side and the end part of the second modified region on the front face side opposing each other is 0 μm to [(the substrate thickness) - (the substrate thickness) \times 0.6] μm .